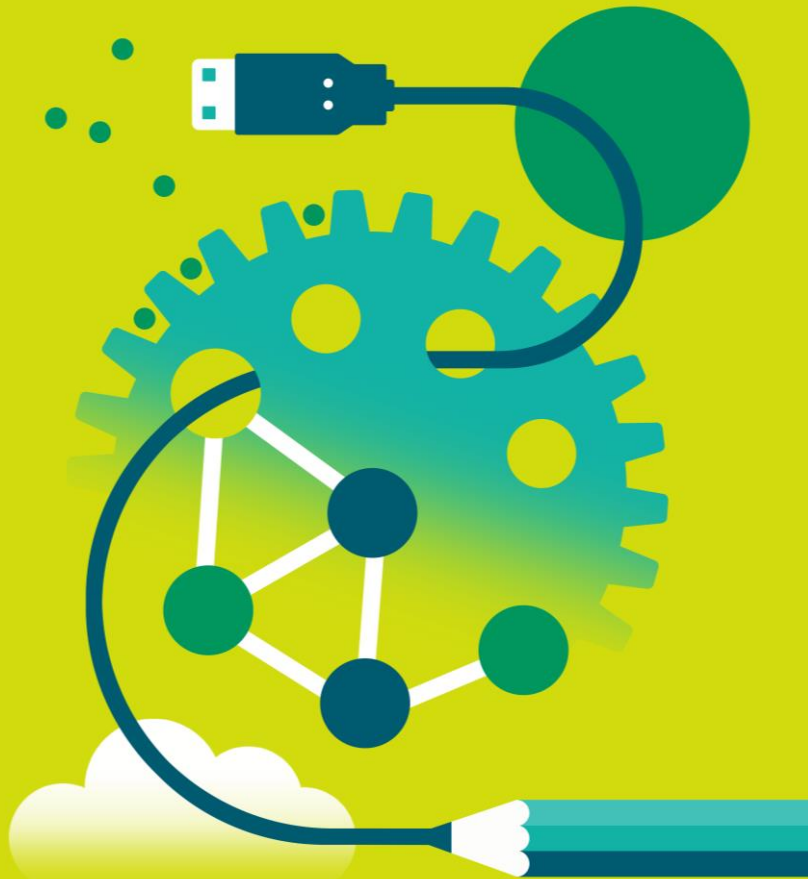




Pearson

Getting ready to teach the Pearson Edexcel International GCSE Mathematics A (9-1) (4MA1) Live online event

Course Code : 16IOAM09



Your Online Environment

XX Technical Difficulties & Support

XX Recording

XX Communication in an online environment

XX Asking Questions

XX Using Polls

XX Downloading Documents

Aims and Objectives

During the training you will:

- Consider the updated structure, content and assessment of this qualification, and the support available to guide you through these changes
- Explore possible teaching and delivery strategies for the new qualification
- Learn about the new 9-1 grading scale
- Explore exemplar student work to support your understanding of the new mark scheme.

Session Agenda

- 16:00 Introductions
- 16:05 Introduction to specification changes and the new grading system
- 16:20 Changes to Foundation level with student exemplar material
- 16:55 Comfort break
- 17:00 Continue with Foundation level changes
- 17:15 Higher level changes with student exemplar material
- 18:00 End of session

**Polls to get to know
the delegates.**

Polls

1. How long have you been teaching this qualification and subject?
2. What is your role?
3. How many other colleagues are attending the session with you today?
4. Roughly what percentage of your current cohort are entered for Higher Tier?

Following consultations we are making the following changes to International GCSE Maths:

- A move from the current A* - G to the new 9–1 grading structure to maintain comparability to GCSE 9-1 Maths
- Some minor additions to the content assessed at each tier to reflect this new 9-1 grading structure
- A few more questions on problem-solving and mathematical reasoning

...but...

- The changes are natural extensions of the current content
- The changes should not involve a large amount of extra teaching time
- Questions requiring the use of Problem solving and mathematical reasoning are nothing new to the International GCSE specification – there is just a slight increase in these
- Question types and language used will be very similar to those on the current specification

New GCSE 9-1 grading scale

- New grading scale – therefore no direct comparability with old A*-G
- Levels 4 and 5 align to old grade C
- Level 7 aligns to grade A
- Level 8 & 9 align to grade A*
- Level 9 represents a higher level of attainment than A* grade boundary
- Introduced in GCSE in 3 phases 2015-2017
- Introduced into new International GCSE in one phase for first teaching September 2017
- Option to start early for English and Maths from September 2016

CURRENT	NEW INTERNATIONAL GCSE
A*	9
A	8
B	7
C	6
D	5
E	4
F	3
G	2
U	1
	U

New GCSE 9-1 grading scale

Why the new scale gives learners better opportunities?

- Gives greater scope to differentiate across the levels of attainment, rewarding outstanding achievement
- Rewards outstanding achievement
- Gives teachers more information about students' attainment to help progress to A Level
- Internationally relevant: Grade 5 linked with best available evidence of average PISA performance in high performing countries
- Aligning with English national practice ensures international recognition and understanding from universities and ministries around the world
- Allows clear comparison with English standards, unlike old A* to G grading

FAQs

<http://qualifications.pearson.com/content/dam/pdf/News/general-news/Edexcel-International-GCSE-FAQs-for-international-schools-only.pdf>

CURRENT	NEW INTERNATIONAL GCSE
A*	9
A	8
	7
B	6
	5
C	4
	3
D	2
E	1
F	
G	
U	U

Timeline for International GCSE Mathematics (UK)

Mathematics A					
	May/June 2017	Jan 2018	May/June 2018	Jan 2019	May/June 2019
Current specification: 4MA0	Assessment window	Assessment window	Final May/June series assessment window	Final ever assessment opportunity	Not available
New specification 4MA1	Not available	Not available	Optional first assessment	January series available	May/June series available (Compulsory assessment window for all centres)

New specifications and Sample assessment materials for International GCSE Maths 4MA1 in schools early in 2016 and training available

Assessment Structure

Foundation

Paper number	Level	Assessment information	Number of raw marks allocated in the paper
Paper 1F (calculator allowed)	Foundation	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 5 – 1.	100
Paper 2F (calculator allowed)	Foundation	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 5 – 1.	100

Assessment Structure

Higher tier

Paper number	Level	Assessment information	Number of raw marks allocated in the paper
Paper 3H (calculator allowed)	Higher	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 9 – 4 with 3 allowed.	100
Paper 4H (calculator allowed)	Higher	Assessed through a 2 hour examination set and marked by Edexcel. The paper is weighted at 50% of the qualification, targeted at grades 9 – 4 with 3 allowed.	100

Which tier of entry: Foundation or Higher?

- The new Foundation tier goes up to a grade 5, which is of a higher level of demand than the current grade C, and the Higher tier starts at grade 4, which is of a higher level of demand than the current grade D. We expect this to have an effect on the number of Foundation and Higher students.
- Consider how confident your students are with topics that were previously regarded as C grade.
- Common questions on the SAMs appear at the end of the Foundation tier papers and form the first part of the Higher tier paper – how well your students perform on these questions will give you an indication if they are working below, at or above grades 4 & 5 (the target grades for these questions)

Poll: Do you expect more of your students to be entered for foundation than previously?

Subject Areas on Specification

A01 (57 – 63%)

- Numbers and the number system
- Equations, formulae and identities
- Sequences, functions and graphs

A02 (22 – 28%)

- Geometry
- Vectors and transformation geometry

A03 (12 – 18%)

- Statistics and probability

Relationship of assessment objectives to units

Unit number	Assessment objective		
	AO1	AO2	AO3
Papers 1F and 2F	28.5–31.5%	11–14%	6–9%
Papers 3H and 4H	28.5–31.5%	11–14%	6–9%
Total for International GCSE	57–63%	22–28%	12–18%

A01 Split for Foundation and Higher

A01 (57 - 63% of marks)

Foundation
Number : Algebra
3 : 2

Higher
Number : Algebra
1 : 2

Relationship of problem solving and mathematical reasoning skills to tier

	Problem solving	Reasoning, interpretation and Communication
Foundation (1F and 2F)	25%	15%
Higher (3H and 4H)	30%	20%

Marks allocated to Grades

Higher tier

- 40% marks distributed evenly over grades 4 & 5
- 60% of marks distributed over grades 6, 7, 8 & 9

Foundation tier

- All marks distributed evenly over grades 1, 2, 3, 4 & 5

Content changes

- Very similar to KMA0 and 4MA0
- Some topics have moved so that they can be assessed on the Foundation tier papers as well as on the Higher tier papers in order to accommodate the award of grade 5 at Foundation level.
- Introduction of density and pressure.
- Slight increase in the number of questions targeting problem solving as well as questions targeting reasoning, interpretation and communication.
- Reference to Pythagoras' theorem and the trigonometric ratios has been deleted from the formula sheet; candidates are expected to know them.

Foundation tier

There is new content in the foundation tier - some of this is to accommodate the grade 5 which is now available at this tier.

Fractions

1.2 Fractions	F use common denominators to add and subtract fractions <u>and mixed numbers</u>
	I multiply and divide fractions <u>and mixed numbers</u>

SAMs Paper 2F q25 / Paper 4H q10 (part (b) only)

(a) Show that $\frac{5}{9} + \frac{1}{6} = \frac{13}{18}$ (2)

(b) Show that $4\frac{2}{3} \div 3\frac{5}{9} = 1\frac{5}{16}$ (3)

Decimals

1.3 Decimals	B understand place value
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Candidates are expected to be able to write down the value of, for example, the digit 5 in the number 32.157

Powers and roots

1.4 Powers and roots	C use index notation and index laws for multiplication and division of positive <u>and negative</u> integer powers <u>including zero</u>
	E find highest common factors (HCF) and lowest common multiples (LCM)

Candidates may, for example be asked to simplify $5^{-6} \times 5^2$ and give their answer as a power of 5

SAMs Paper 2F q16 / Paper 4H q1

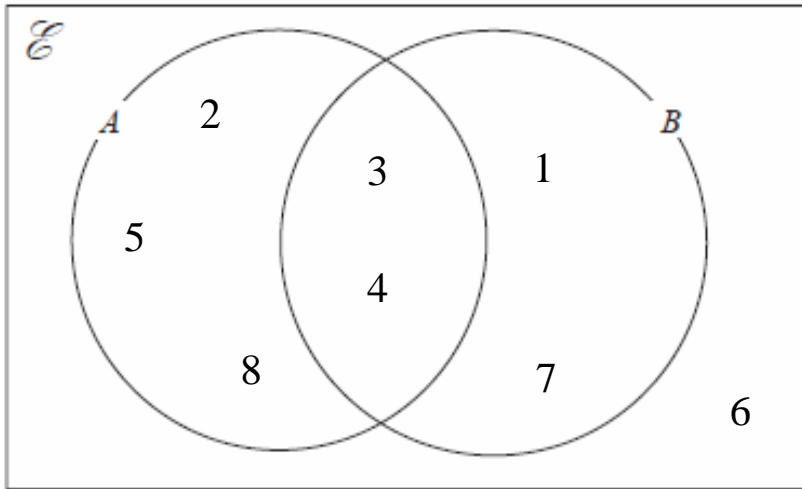
Find the lowest common multiple (LCM) of 20, 30 and 45

(3)

Set language and notation

1.5 Set language and notation	D understand and use the complement of a set
	E use Venn diagrams to represent sets

e.g. The Venn diagram shows Universal set and the numbers in the sets A and B .



Write down the members of the sets

(i) A

(ii) B'

Percentages

1.6 Percentages	F use reverse percentages
	G use compound interest and depreciation

SAMs Paper 1F q23 / Paper 3H q8

In a sale, all normal prices are reduced by 15%

The normal price of a mixer is reduced by 22.50 dollars.

Work out the normal price of the mixer.

(3)

SAMs Paper 2F q23 / Paper 4H q8

Kwo invests HK\$40 000 for 3 years at 2% per year compound interest.

Work out the value of the investment at the end of 3 years.

(3)

SAMs Paper 2F Q23 / Paper 4H Q8

Kwo invests HK\$40 000 for 3 years at 2% per year compound interest.

Work out the value of the investment at the end of 3 years.

(3)

AO1 Numbers and Algebra

1.6 Percentages **G** use compound interest and depreciation.

Marking

M1 $0.02 \times 40\,000 (=800)$ or $1.02 \times 40\,000 (=40800)$ or 2400

M1 for method to find interest for year 2 **and** year 3

“40800” $\times 0.02 (=816)$ and “41616” $\times 0.02 (=832.32)$ **OR** 2448.32

(M2 for $40\,000 \times 1.02^3$)

A1 42448.32

8. Kwo invests HK\$40 000 for 3 years at 2% per year compound interest.
Work out the value of the investment at the end of 3 years.

$$40000 \times 3 = 120000$$

$$2\% \times 120000 = 2400$$

$$40,000 + 2400 = 42,400$$

Marking

M1 $0.02 \times 40\,000 (=800)$ or $1.02 \times 40\,000 (=40800)$ or 2400

M1 for method to find interest for year 2 **and** year 3

“40800” $\times 0.02 (=816)$ and “41616” $\times 0.02 (=832.32)$ **OR** 2448.32

(M2 for $40\,000 \times 1.02^3$)

A1 42448.32

HK\$.....42,400.....

(Total for Question 8 is 3 marks)

8. Kwo invests HK\$40 000 for 3 years at 2% per year compound interest.
Work out the value of the investment at the end of 3 years.

$$40000 \times 1.2 \times 1.2 \times 1.2 = 69120$$

Marking

M1 $0.02 \times 40\,000 (=800)$ or $1.02 \times 40\,000 (=40800)$ or 2400

M1 for method to find interest for year 2 **and** year 3

“40800” $\times 0.02 (=816)$ and “41616” $\times 0.02 (=832.32)$ **OR** 2448.32

(M2 for $40\,000 \times 1.02^3$)

A1 42448.32

HK\$.....69120.....

(Total for Question 8 is 3 marks)

8. Kwo invests HK\$40 000 for 3 years at 2% per year compound interest. Work out the value of the investment at the end of 3 years.

$$\frac{40000}{100} = ? \times 2 = 1 \text{ year} \quad 800$$

⇓

$$40000 + 800$$

⇓

$$\frac{40800}{100} \times 2 = 2 \text{ year} = 816$$

$$\frac{41616}{100} \times 2 = 832.32$$

HK\$..... 832.32

(Total for Question 8 is 3 marks)

Marking

M1 $0.02 \times 40\,000 (=800)$ or $1.02 \times 40\,000 (=40800)$ or 2400

M1 for method to find interest for year 2 **and** year 3

“40800” $\times 0.02 (=816)$ and “41616” $\times 0.02 (=832.32)$ **OR** 2448.32

(M2 for $40\,000 \times 1.02^3$)

A1 42448.32

Standard form

1.9 Standard form

A calculate with and interpret numbers in the form $a \times 10^n$ where n is an integer and $1 \leq a < 10$

SAMs Paper 1F q24 / Paper 3H q9

The table shows the diameters, in kilometres, of five planets.

Planet	Diameter (km)
Venus	1.2×10^4
Jupiter	1.4×10^5
Neptune	5.0×10^4
Mars	6.8×10^3
Saturn	1.2×10^5

(a) Write 1.4×10^5 as an ordinary number.

(1)

(b) Which of these planets has the smallest diameter?

(1)

(c) Calculate the difference, in kilometres, between the diameter of Saturn and the diameter of Neptune.

Give your answer in standard form.

(2)

Equations, formulae and identities

2.1 Use of symbols	C use index notation for positive <u>and</u> <u>negative</u> integer powers (<u>including zero</u>)
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SAMs Paper 2F q19 / Paper 4H q4

(a) Simplify $p^5 \times p^4$ (1)

(b) Simplify $(m^4)^{-3}$ (1)

(c) Write down the value of c^0 (1)

Algebraic manipulation

2.2 Algebraic manipulation	D	take out common factors
	F	understand the concept of a quadratic expression and be able to factorise such expressions (limited to $x^2 + bx + c$)

SAMs Paper 1F q21a / Paper 3H q6a

Factorise fully $18e^3f + 45e^2f^4$ (2)

e.g. Factorise $x^2 + 2x - 15$, factorise $x^2 - 25$

Expressions and formulae

2.3 Expressions and formulae	F change the subject of a formula where the subject appears once
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For example: make q the subject of $x = 7q + 3$

or make y the subject of $w = 6y^2$

2.6 Simultaneous linear equations	A calculate the exact solution of two simultaneous equations in two unknowns
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SAMs Paper 2F q24 / Paper 4H q9

Solve the simultaneous equations $3x + y = 13$

$$x - 2y = 9$$

Show clear algebraic working.

(3)

The requirement to show clear algebraic will still be given (as here); the correct answer without supporting algebraic working will not score any marks.

2.7 Quadratic expressions	A solve quadratic equations by factorisation (limited to $x^2 + bx + c = 0$)
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SAMs Paper 1F q21b / Paper 3H q6b

Solve $x^2 - 4x - 12 = 0$

Show clear algebraic working.

(3)

SAMs Paper 1F q21b / Paper 3H q6b

Solve $x^2 - 4x - 12 = 0$

Show clear algebraic working.

(3)

AO1 Numbers and Algebra

2.7 Quadratic equations **A** solve quadratic equations by factorisation (limited to $x^2 + bx + c = 0$)

Marking

M1 $(x \pm 6)(x \pm 2)$ or correct substitution into quadratic formula (allow one sign error)

M1 $(x - 6)(x + 2)$ or $\frac{4 \pm \sqrt{64}}{2}$

A1 6, -2 dependent on at least M1

Marking

M1 $(x \pm 6)(x \pm 2)$ or correct substitution into quadratic formula (allow one sign error)

M1 $(x - 6)(x + 2)$ or $\frac{4 \pm \sqrt{64}}{2}$

A1 6, -2 dependent on at least M1

(b) Solve $x^2 - 4x - 12 = 0$
Show clear algebraic working.
 $a=1$ $b=-4$ $c=-12$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{4 \pm \sqrt{16 - 4(1)(-12)}}{2}$$

$$\frac{4 \pm \sqrt{-32}}{2}$$

B

.....
(3)
(Total for Question 5 is 5 marks)

(b) Solve $x^2 - 4x - 12 = 0$
Show clear algebraic working.

$$x^2 - 4x = 0 + 12$$

$$x^2 - x = \frac{12}{4}$$

$$x - x = \sqrt{\frac{12}{4}}$$

$$x = \sqrt{\frac{12}{4}}$$

A

$\sqrt{\frac{12}{4}}$
.....
(3)
(Total for Question 5 is 5 marks)

(b) Solve $x^2 - 4x - 12 = 0$
Show clear algebraic working.

$$(x - 6)(x + 2)$$

C

$(x - 6)(x + 2)$
.....
(3)
(Total for Question 5 is 5 marks)

Sequences, functions and graphs (A01)

3.1 Sequences	C use linear expressions to describe the n th term of arithmetic sequences
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SAMs Paper 2F q17 / Paper 4H q2

The first four terms of an arithmetic sequence are

2 9 16 23

Write down an expression, in terms of n , for the n th term.

(2)

Graphs

3.3 Graphs	H	recognise that equations of the form $y = mx + c$ are straight line graphs <u>with gradient m and intercept on the y-axis at the point $(0, c)$</u>
	I	<u>recognise</u> , generate points and plot graphs of linear and quadratic functions

The requirement in 3.3H has been extended so that candidates could, for example, be asked to write down the gradient and the coordinates of the y axis intercept of the graph of $y = 3x + 4$. The inclusion of the word 'recognise' in 3.3I means that candidates could, for example, be given the graphs of several linear functions and then be asked to identify which of these is the graph of $y = 2x + 1$

Geometry and Trigonometry (A02)

4.4 Measure	G use compound measure such as speed, density and pressure
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The formula for pressure will be given if required.

The questions from the SAMs shown below is a more demanding question testing knowledge of density in a problem.

SAMs Paper 2F q18 / Paper 4H q3

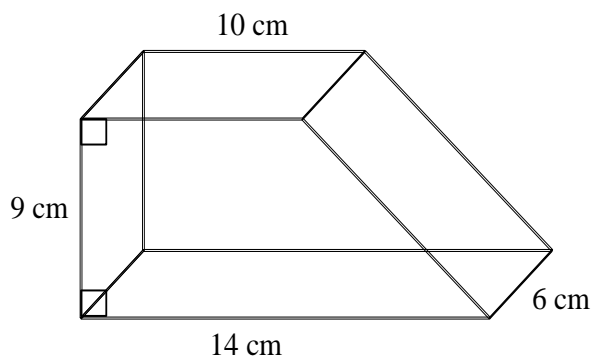


Diagram **NOT** accurately drawn

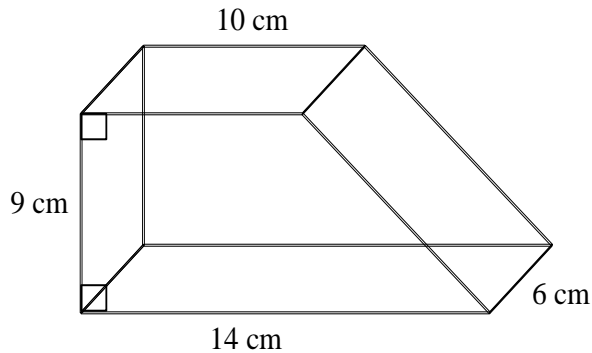
The diagram shows a solid prism.
The cross section of the prism is a trapezium.

The prism is made from wood with density 0.7 g/cm^3

Work out the mass of the prism.

(4)

SAMs Paper 2F q18 / Paper 4H q3



The diagram shows a solid prism.
The cross section of the prism is a trapezium.

The prism is made from wood with
density 0.7 g/cm^3

Work out the mass of the prism.

(4)

AO2 Shape, space and measure

4.4 Measures G use compound measure such as speed, *density* and pressure

Marking

M1 for area of cross section $0.5 \times (10 + 14) \times 9$ oe (= 108)

M1 volume of prism (dep on previous M1) “108” $\times 6$ (= 648)

M1 “648” $\times 0.7$ (independent)

A1 453.6 (accept 454)

Work out the mass of the prism.

$$\text{volume} = \text{area of cross section} \times \text{length}$$

$$\text{mass} = d \times v$$

$$d = 0.7$$

$$v = 90 + \frac{45}{2}$$

$$90 + 22.5$$

$$= 112.5 \times 14 = \underline{1575 \text{ cm}^3} \times \underline{0.7 \text{ g/cm}^3}$$

A

1102.5

g
(Total for Question 4 is 4 marks)

$$\frac{1}{2}(a+b)h = 108$$

$$0.5(10+14)9$$

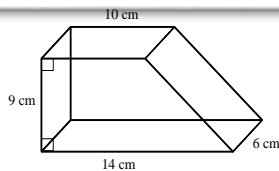
$$108 \div 0.7 \text{ g/cm}^3$$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

B

154.9

(Total for Question 4 is 4 marks)



Marking

M1 for area of cross section $0.5 \times (10 + 14) \times 9$ oe (= 108)

M1 volume of prism (dep on previous M1) "108" $\times 6$ (= 648)

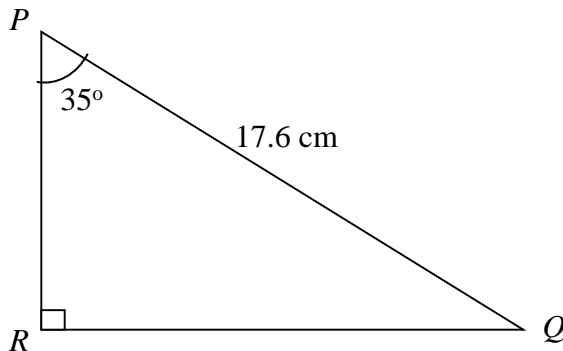
M1 "648" $\times 0.7$ (independent)

A1 453.6 (accept 454)

Trigonometry and Pythagoras (A02)

4.8 Trigonometry and Pythagoras' theorem	A <u>know</u> , understand and use Pythagoras' Theorem in two dimensions
	B <u>know</u> , understand and use sine, cosine and tangent of acute angles to determine lengths and angles of a right-angled triangle

SAMs Paper 1F q22 / Paper 3H q7



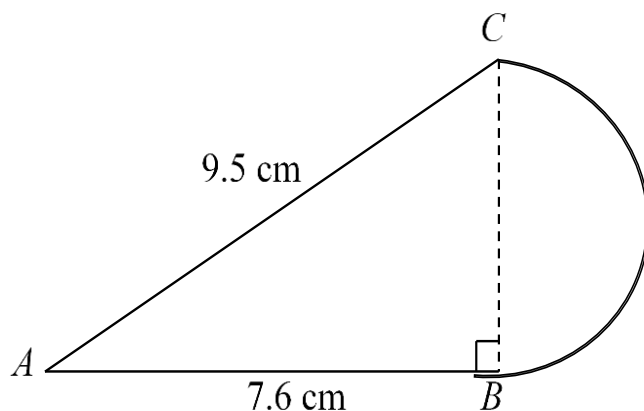
Calculate the length of PR .
Give your answer correct to 3 significant figures.

(3)

4.9 Mensuration of 2-D shapes

E find circumferences and areas of circles using relevant formulae; find perimeters and areas of semicircles

SAMs Paper 1F q25 / Paper 3H q10



The diagram shows a shape made from triangle ABC and a semicircle with diameter BC . Triangle ABC is right-angled at B . $AB = 7.6$ cm and $AC = 9.5$ cm.

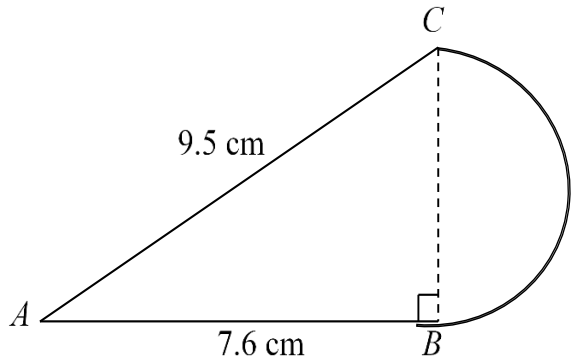
Calculate the area of the shape.
Give your answer correct to 3 significant figures.

(5)

Diagram **NOT** accurately drawn

This question is a good example of one requiring 'problem solving skills' in that the student needs to translate the problem into a series of mathematical processes – the student needs to interpret the question and decide how to solve it.

SAMs Paper 1F q25 / Paper 3H q10



The diagram shows a shape made from triangle ABC and a semicircle with diameter BC . Triangle ABC is right-angled at B . $AB = 7.6$ cm and $AC = 9.5$ cm.

Calculate the area of the shape.
Give your answer correct to 3 significant figures.

AO2 Shape, space and measure

4.9 mensuration of 2D shapes **E** ...find perimeters and areas of semicircles.

Marking

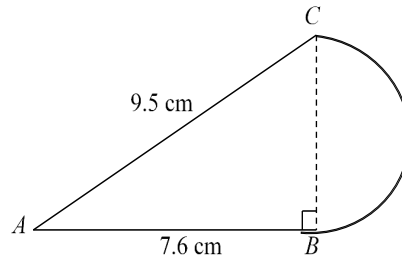
M1 $\sqrt{9.5^2 - 7.6^2}$ oe

A1 (BC =) 5.7

M1 dep on first M1 for $0.5 \times 7.6 \times '5.7'$ or 21.6(6) or 21.7 oe

M1 $0.5 \times \pi \times ('5.7' \div 2)$ or 12.7(587...) or 12.8

A1 34.4



$AB = 7.6$ cm and $AC = 9.5$ cm.

Calculate the area of the shape.
Give your answer correct to 3 significant figures.

Handwritten student work:

$$a^2 + b^2 = c^2$$

$$7.6^2 + b^2 = 9.5^2$$

$$57.76 + b^2 = 90.25$$

$$b^2 = 90.25 - 57.76$$

$$b^2 = 32.49$$

$$b = \sqrt{32.49}$$

$$b = 5.7$$

12.8cm²

(Total for Question 10 is 5 marks)

Marking

M1 $\sqrt{9.5^2 - 7.6^2}$ oe

A1 (BC =) 5.7

M1 dep on first M1 for $0.5 \times 7.6 \times '5.7'$ or 21.6(6) or 21.7
oe

M1 $0.5 \times \pi \times ('5.7' \div 2)$ or 12.7(587...) or 12.8

A1 34.4

Give your answer correct to 3 significant figures.

Pythag. equ. $\rightarrow a^2 = b^2 + c^2$

$$c^2 - b^2 = a^2$$

$$\sqrt{c^2 - b^2} = a$$

$$\sqrt{9.5^2 - 7.6^2} = a$$

$$a = 5.7 \text{ cm}$$

$$BC = 5.7 \text{ cm}$$

$$\frac{5.7}{2} = 2.85$$

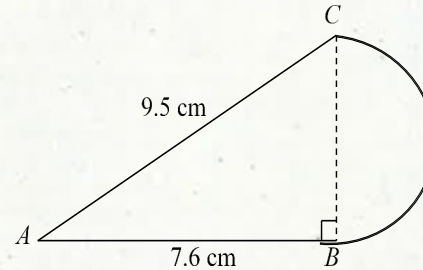
$$\pi r^2$$

$$\pi \times (2.85)^2 = 25.517586$$

$$\text{Area of Semi circle} = 25.517586$$

$$\text{Area of triangle} = \frac{5.7 \times 7.6}{2} = 21.66$$

$$21.66 + 25.517586$$



Marking

M1 $\sqrt{9.5^2 - 7.6^2}$ oe

A1 (BC =) 5.7

M1 dep on first M1 for $0.5 \times 7.6 \times '5.7'$ or 21.6(6) or 21.7 oe

M1 $0.5 \times \pi \times ('5.7' \div 2)$ or 12.7(587...) or 12.8

A1 34.4

47.2

.....cm²

(Total for Question 10 is 5 marks)

$AB = 7.6$ cm and $AC = 9.5$ cm.

Calculate the area of the shape.

Give your answer correct to 3 significant figures.

$$9.5^2 - 7.6^2 = 12$$

$$90.25 - 57.76 = 32.49$$

$$\sqrt{32.49} = \boxed{5.7}$$

$$A_{\text{circle}} = \pi r^2$$

$$= 5.7^2 \pi = 102.0703953$$

$$\text{or } \boxed{102} \approx \boxed{56.3}$$

$$\text{Area of triangle } \frac{1}{2} b \times h$$

$$= \frac{1}{2} 5.7 \times 9.5 = 27.075 + 56.3$$

$$83.375 \approx \boxed{83.4}$$

$$83.4 \text{ cm}^2$$

(Total for Question 10 is 5 marks)

Marking

M1 $\sqrt{9.5^2 - 7.6^2}$ oe

A1 (BC =) 5.7

M1 dep on first M1 for $0.5 \times 7.6 \times '5.7'$ or 21.6(6) or 21.7 oe

M1 $0.5 \times \pi \times ('5.7' \div 2)$ or 12.7(587...) or 12.8

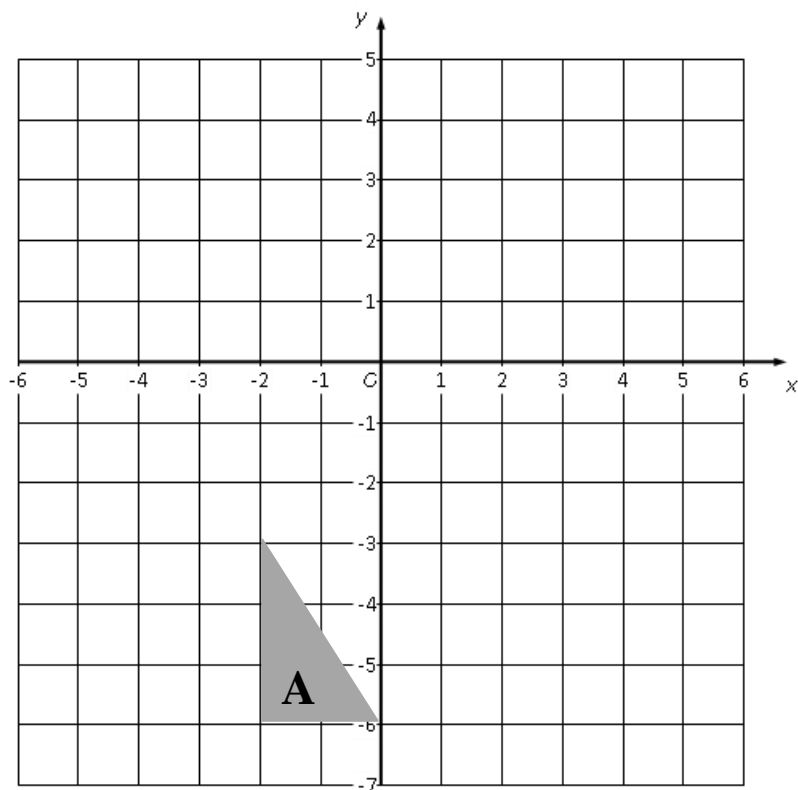
A1 34.4

Vectors and transformation geometry (A02)

5.2 Transformation
geometry

H understand and use column vectors in
translations

SAMs Paper 2F q21 / Paper 4H q6



(a) On the grid, translate triangle **A** by
the vector $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$

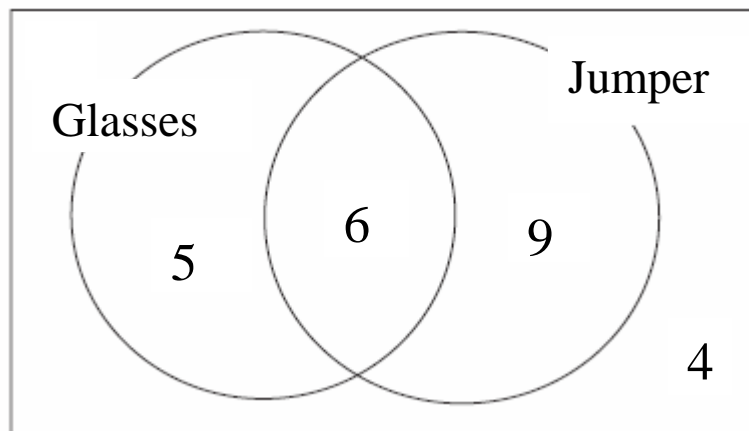
(1)

Statistics and probability (A03)

6.3 Probability

D Find probabilities from a Venn diagram.

This will link in with the new work in section 1.5



The Venn diagram shows the number of children in a class wearing a jumper or glasses.

A child is selected at random.

Find the probability that the child is wearing glasses but is not wearing a jumper.

Higher Tier

Assumes knowledge of Foundation tier – all content included in Foundation tier could be assessed in the Higher tier papers, provided that the question is targeting at least grade 4

Numbers and the number system (A01)

1.4 Powers and roots

B manipulate surds, including rationalising a denominator

SAMs Paper 4H q24

Show that $\frac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

(4)

SAMs Paper 4H q24

Show that $\frac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

AO1 Numbers and the number system

1.4 Powers and roots **B** manipulating surds, including rationalising a denominator

Marking

M1 method to rationalise $\frac{(\sqrt{12}-1)(2+\sqrt{3})}{(2-\sqrt{3})(2+\sqrt{3})}$

M1 correct expansion of brackets $\frac{2\sqrt{12}-2+\sqrt{12}\sqrt{3}-\sqrt{3}}{4-3}$

B1 $\sqrt{12} = 2\sqrt{3}$ (may be seen before expansion)

A1 answer from fully correct working with all steps seen

10. Show that $\frac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

A

$$\frac{\sqrt{12}-1}{2-\sqrt{3}} = 4+3\sqrt{3}$$

$$\sqrt{12}-1 = 4+3\sqrt{3} \times (2-\sqrt{3})$$

$$\sqrt{12}-1 = 8-4\sqrt{3}+6\sqrt{3}-9$$

$$\sqrt{12} = -1+2\sqrt{3}$$

$$2\sqrt{3} = -1+1+2\sqrt{3}$$

$$2\sqrt{3} = 2\sqrt{3}$$

Left side = right side

$$\therefore \frac{\sqrt{12}-1}{2-\sqrt{3}} \text{ can be written as } 4+3\sqrt{3}$$

$$\begin{aligned} & \frac{\sqrt{12}-1}{2-\sqrt{3}} \\ &= \frac{2\sqrt{3}-1}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}} \\ &= \frac{6-1}{2-\sqrt{3}} = \frac{5}{2-\sqrt{3}} \\ &= \frac{\sqrt{4} \times 3 - 1}{2-\sqrt{3}} \\ &= \frac{\sqrt{12} \times 3 - 1}{2-\sqrt{3}} \\ &= \frac{3\sqrt{12}-1}{2-\sqrt{3}} \end{aligned}$$

(Total for Question 10 is 4 marks)

10. Show that $\frac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

C

$$\frac{\sqrt{12}-1}{2-\sqrt{3}} = \frac{\sqrt{4 \times 3}-1}{2-\sqrt{3}} = \frac{2\sqrt{3}-1}{2-\sqrt{3}} \times \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{3\sqrt{3}}{4-3}$$

$$(\cancel{2\sqrt{3}-1} \times \cancel{2+\sqrt{3}}) = \cancel{4\sqrt{3}+2\sqrt{3}-2-\sqrt{3}}$$

$$= \cancel{2\sqrt{3}} (2\sqrt{3}-1)(2+\sqrt{3})$$

$$(2-\sqrt{3})(2+\sqrt{3}) = 4\sqrt{3}-2+6-\sqrt{3}$$

$$= 4 - \cancel{2\sqrt{3}} + \cancel{2\sqrt{3}} - \sqrt{3}$$

$$= 4 - \sqrt{3}$$

(Total for Question 10 is 4 marks)

10. Show that $\frac{\sqrt{12}-1}{2-\sqrt{3}}$ can be written as $4+3\sqrt{3}$

Show your working clearly.

B

$$\frac{\sqrt{12}-1}{2-\sqrt{3}}$$

$$= \frac{\sqrt{12}-1 \times (2+\sqrt{3})}{2-\sqrt{3} \times (2+\sqrt{3})}$$

$$= \frac{2\sqrt{12} + \sqrt{36} - 2 - \sqrt{3}}{2^2 - 3}$$

$$\begin{aligned} & \frac{2\sqrt{12} + \sqrt{36} - 2 + \sqrt{3}}{1} \\ &= \frac{2\sqrt{4 \times 3} + \sqrt{36} - 2 + \sqrt{3}}{1} \\ &= \frac{2\sqrt{4 \times 3} + 6 - 2 + \sqrt{3}}{1} \\ &= \frac{4\sqrt{3} - \sqrt{3} + 4}{1} \\ &= \frac{3\sqrt{3} + 4}{1} \\ &= 4 + 3\sqrt{3} \end{aligned}$$

(Total for Question 10 is 4 marks)

Marking

M1 method to rationalise $\frac{(\sqrt{12}-1)(2+\sqrt{3})}{(2-\sqrt{3})(2+\sqrt{3})}$

M1 correct expansion of brackets $\frac{2\sqrt{12}-2+\sqrt{12}\sqrt{3}-\sqrt{3}}{4-3}$

B1 $\sqrt{12} = 2\sqrt{3}$ (may be seen before expansion)

A1 answer from fully correct working with all steps seen

Teaching surd division

- Make connections with the difference of two squares
- Prepare candidates for “show that” questions:
 - Make sure they write down and show the multiplication by
for example $\frac{2+\sqrt{3}}{2+\sqrt{3}}$
 - Put in every step e.g. write $\sqrt{12} \times \sqrt{3}$ not just 6 and don't just assume that $\sqrt{12} = 2\sqrt{3}$ but write $\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$
- Prepare candidates for questions using algebra e.g.
 - Given that $\frac{6}{a-\sqrt{b}} = 8 + 2\sqrt{b}$, where a is an integer and b is a prime number, find the value of a and the value of b .

Equations, formulae and identities (A01)

2.2 Algebraic manipulation	A	expand the product of two <u>or more</u> linear expressions
	D	complete the square for a given quadratic expression
	E	use algebra to support and construct proofs

SAMs Paper 3H q11

(3)

Expand and simplify $(x + 5)(x - 3)(x + 3)$

KMAO June 2015 Paper 4H q20b

Show, using algebra, that the sum of any 4 consecutive odd numbers is always a multiple of 8

(3)

1MA0 June 2014 Paper 2H q21b

Prove algebraically that

$(2n + 1)^2 - (2n + 1)$ is an even number for all positive integer values of n .

Multiplying out brackets

- Now 2 or more, **not just two**.
- Start with simple “tools” e.g. FOIL, smiley face etc
- E.g. $(x + 5)(x - 3) = x^2 - 3x + 5x - 15$ etc
- **BUT ... don't leave them there!**
- Students now need a method that generalises
- E.g. $(x + 5)(x - 3) = x(x - 3) + 5(x - 3)$ etc

1MA0 June 2014 Paper 2H Q21b

Prove algebraically that

$(2n + 1)^2 - (2n + 1)$ is an even number for all positive integer values of n .

AO1 Number and algebra

2.2 Algebraic manipulation **E** use algebra to support and construct proofs

Marking

M1 for 3 out of 4 terms correct in the expansion of $(2n + 1)^2$
or $(2n + 1)((2n+1)^2 - 1)$

A1 $4n^2 + 2n$ or equivalent expression in factorised form

A1 for convincing statement using $2n(2n + 1)$ or $2(2n^2 + n)$
or $4n^2 + 2n$

6. Prove algebraically that

$$(2n+1)^2 - (2n+1) \text{ is an even number}$$

A

for all positive integer values of n .

$$\begin{aligned}(2n+1)^2 &= (2n+1)(2n+1) \\ &= 4n^2 + 2n + 2n + 2 \\ &= 4n^2 + 4n + 2\end{aligned}$$

$$\begin{aligned}4n^2 + 4n + 2 - (2n + 1) \\ 4n^2 + 4n + 2 - 2n - 1 \\ = 4n^2 + 2n\end{aligned}$$

any integer will give a positive value
if multiplied by 4 or 2
therefore $4n^2 + 2n$ will always give an
even number if n is a positive integer
(Total for Question 6 is 5 marks)

6. Prove algebraically that

$$(2n+1)^2 - (2n+1) \text{ is an even number}$$

C

for all positive integer values of n .

$$\text{even number } s = 2n(n+1)$$

$$\hookrightarrow (2n+1)(2n+1) = 4n^2 + 4n + 1$$

$$4n^2 + 4n + 1 - (2n + 1)$$

$$= 4n^2 + 2n$$

$$= 2n(n+1)$$

(Total for Question 6 is 5 marks)

6. Prove algebraically that

$$(2n+1)^2 - (2n+1) \text{ is an even number}$$

B

for all positive integer values of n .

$$2n+1 = \text{always an odd number}$$

$$(2n+1)^2 = 4n^2 + 4n + 1 \quad (2n+1)^2 = \text{always an odd number}$$

$$4n^2 + 4n + 1 -$$

$$n > 0$$

$$\therefore (2n+1)^2 - (2n+1)$$

$$= 4n^2 + 4n + 1 - 2n - 1$$

$$= 4n^2 + 2n \rightarrow \text{always an even number}$$

when $n = 1$

$$(2 \times 1 + 1)^2 - (2 \times 1 + 1)$$

$$= (3)^2 - 3$$

$$= 9 - 3$$

$$= 6 \rightarrow \text{even}$$

when $n = 2$

$$(2 \times 2 + 1)^2 - (2 \times 2 + 1)$$

$$= (5)^2 - 5$$

$$= 25 - 5$$

$$= 20 \rightarrow \text{even}$$

(Total for Question 6 is 5 marks)

Marking

M1 for 3 out of 4 terms correct in the expansion of $(2n+1)^2$
or $(2n+1)((2n+1)^2 - 1)$

A1 $4n^2 + 2n$ or equivalent expression in factorised form

A1 for convincing statement using $2n(2n+1)$ or $2(2n^2 + n)$ or $4n^2 + 2n$

2.5 Proportions

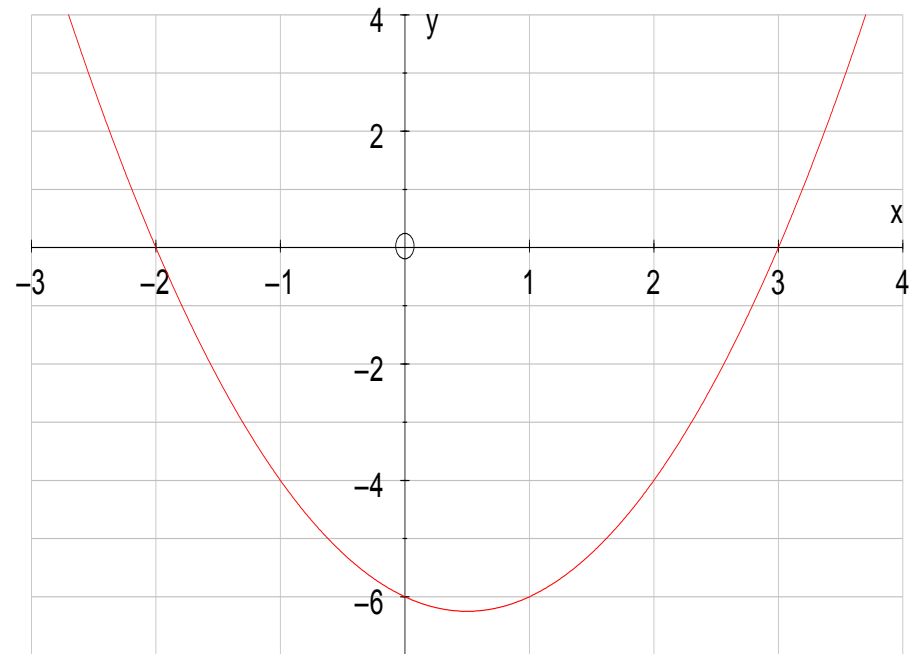
No change in wording but we have added a couple of cases (**in red**) in the notes. This brings into line with spec B

2.5	A set up problems involving direct or inverse proportion...	To include only the following: $y \propto x, y \propto \frac{1}{x}$ and $y \propto x^2, y \propto \frac{1}{x^2}$ $y \propto x^3, y \propto \frac{1}{x^3}$ and $y \propto \sqrt{x}, y \propto \frac{1}{\sqrt{x}}$
-----	--	--

Teaching quadratic inequalities

e.g. $x^2 - x - 6 < 0$

- Find critical values: solve $x^2 - x - 6 = 0$
- $(x - 3)(x + 2) = 0$ so $x = 3$ or -2
- Sketch or table?
- So $-2 < x < 3$
- For $x^2 - x - 6 > 0$
- $x < -2$ or $x > 3$
- **Don't** write $3 < x < -2$



Sequences, functions and graphs (A01)

3.1 Sequences	A	Understand and use common difference (d) and first term (a) in an arithmetic sequence
	B	Know and use n th term $= a + (n - 1)d$
	C	Find the sum of the first n terms of an arithmetic series (S_n)

SAMs Paper 3H q23

The 4th term of an arithmetic series is 17

The 10th term of the same arithmetic series is 35

Find the sum of the first 50 terms of this arithmetic series.

(5)

Arithmetic series

- **Formulae**

- $t_n = a + (n - 1)d$ is **not** given
- $S_n = \frac{n}{2}[2a + (n - 1)d]$ **is** given - proof is not required but it is a “beautiful” piece of mathematics and worth doing even if only in a special case.

- **Question types**

- Given 3rd term and say 8th term of an arithmetic series ...find a and d (simultaneous equations)
- Find the sum of $4 + 7 + 10 + \dots + 109$ (use the t_n formula to find n then the sum formula)
- Questions in context e.g. I save \$10 in week 1 and increase the amount I save each week by \$5.
 - (a) How much do I save in week 40?
 - (b) What is the total amount I have saved after 40 weeks?

SAMs Paper 3H q23

The 4th term of an arithmetic series is 17

The 10th term of the same arithmetic series is 35

Find the sum of the first 50 terms of this arithmetic series.

(5)

3.1 Sequences	A	Understand and use common difference (d) and first term (a) in an arithmetic sequence
	B	Know and use n th term $= a + (n - 1)d$
	C	Find the sum of the first n terms of an arithmetic series (S_n)

Marking
M1 for $a + 3d = 17$ and $a + 9d = 35$ or $35 - 17 = 6d$ A1 $d = 3$ A1 $a = 8$ (ft from $d = 3$) M1 for $50/2(2 \times '8' + (50 - 1) \times '3')$ oe A1 4075

1. The 4th term of an arithmetic series is 17.
The 10th term of the same arithmetic series is 35.

Find the sum of the first 50 terms of this arithmetic series.

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$S_{50} = 25 [2a + 49d]$$

$$S_n = a + (n-1)d$$

$$S_4 = a + 3d$$

$$17 = a + 3d$$

$$S_5 = a + 9d$$

$$35 = a + 9d$$

$$\begin{array}{r} 35 = a + 9d \\ - 17 = a + 3d \\ \hline 18 = 6d \end{array}$$

$$18 = 6d$$

$$d = 3$$

$$\begin{array}{r} a = 17 - 9 \\ = 8 \end{array}$$

$$\begin{array}{r} S_{50} = 25 [16 + 147] \\ = 4075 \end{array}$$

(Total for Question 9 is 5 marks)

Marking

M1 for $a + 3d = 17$ **and** $a + 9d = 35$ **or** $35 - 17 = 6d$

A1 $d = 3$

A1 $a = 8$ (ft from $d = 3$)

M1 for $50/2(2 \times '8' + (50 - 1) \times '3')$ **oe**

A1 4075

$$\begin{array}{cccccccc}
 17\frac{1}{2} & 34\frac{1}{3} & 85\frac{5}{6} & -17\frac{1}{6} & & & & \\
 n_1 & n_2 & n_3 & n_4 & n_5 & n_6 & n_7 & n_8
 \end{array}$$

9. The 4th term of an arithmetic series is 17.
The 10th term of the same arithmetic series is 35.

Find the sum of the first 50 terms of this arithmetic series.

$$n_4 = 17 \quad n_{10} = 35$$

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$S_n = 25 \left[17 + (49) \times \frac{17}{6} \right]$$

$$= \underline{\underline{3895.83}} \quad \approx \quad \cancel{3895} \underline{\underline{3900}}$$

$$\begin{aligned}
 n &= 50 \\
 d &= \frac{35-17}{6} = \frac{17}{6} \\
 a &= 8.5
 \end{aligned}$$

(Total for Question 9 is 5 marks)

Marking

M1 for $a + 3d = 17$ **and** $a + 9d = 35$ **or** $35 - 17 = 6d$

A1 $d = 3$

A1 $a = 8$ (ft from $d = 3$)

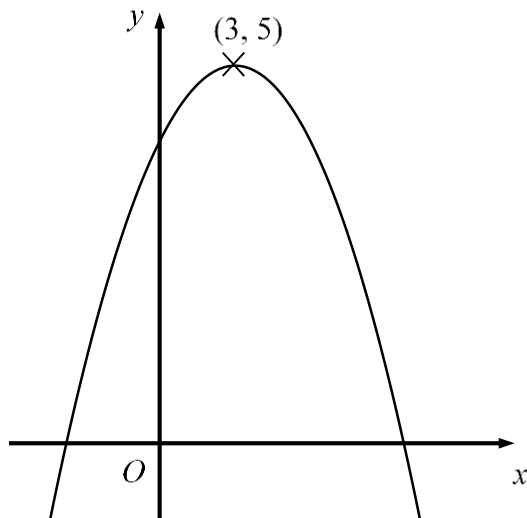
M1 for $50/2(2 \times '8' + (50 - 1) \times '3')$ **or**

A1 4075

Graphs

3.3 Graphs	<p>A <u>Recognise</u>, plot and draw graphs with equation:</p> $y = Ax^3 + Bx^2 + Cx + D \quad \text{in which:}$ <p>(i) The constants are integers and some could be zero (ii) The letters x and y can be replaced with any other two letters or:</p> $y = Ax^3 + Bx^2 + Cx + D + \frac{E}{x} + \frac{F}{x^2} \quad \text{in which:}$ <p>(i) The constants are numerical and at least three of them are zero (ii) The letters x and y can be replaced with any other two letters or: <u>$y = \sin x$, $y = \cos$, $y = \tan x$ for angles of any size (in degrees)</u></p>
	<p>B apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$, $y = f(ax)$, $y = f(x + a)$, $y = af(x)$ for linear, quadratic, sine and cosine functions</p>
	<p>C interpret and analyse transformations of functions and write the functions algebraically</p>
	<p>G find the equation of a straight line parallel to a given line; <u>find the equation of a straight line perpendicular to a given line</u></p>

SAMs Paper 3H q20



The diagram shows part of the curve with equation $y = f(x)$

The coordinates of the maximum point of the curve are $(3, 5)$

(a) Write down the coordinates of the maximum point of the curve with equation

(i) $y = f(x + 3)$ (1)

(ii) $y = 2f(x)$ (1)

(iii) $y = f(3x)$ (1)

The curve with equation $y = f(x)$ is transformed to give the curve with equation $y = f(x) - 4$

(b) Describe the transformation. (1)

SAMs Paper 3H q13b

Line L_1 has equation $y = 3x + 5$

Line L_2 has equation $6y + 2x = 1$

(b) Show that L_1 is perpendicular to L_2

(2)

A good way for students to explain this is to give the two gradients and then show that they multiply to make -1 and explain that this means the lines are perpendicular, e.g.

3. Line L_1 has equation $y = 3x + 5$
Line L_2 has equation $6y + 2x = 1$
Show that L_1 is perpendicular to L_2

$$y = 3x + 5 \quad m^1 = 3$$

$$6y + 2x = 1$$

$$6y = 1 - 2x$$

$$y = \frac{1}{6} - \frac{1}{3}x \quad m^2 = -\frac{1}{3}$$

perpendicular lines:

The gradient multiplied gives -1

$$m^1 \times m^2 = -1$$

$$3 \times -\frac{1}{3} = -1$$

Therefore they are
perpendicular

(Total for Question 3 is 2 marks)

Calculus

3.4 Calculus

D Now includes a reference to stationary points

Geometry and Trigonometry (A02)

No new content

But the change in this area is that any reference to Pythagoras' theorem and the trigonometric ratios has been deleted from the formula sheet.

Vectors and transformation geometry (A02)

5.1 Vectors	C understand and use vector notation <u>including column vectors</u>
-------------	--

SAMs Paper 4H q23

$ABCD$ is a parallelogram.

$$\overrightarrow{AB} = \begin{pmatrix} 2 \\ 3 \end{pmatrix} \quad \overrightarrow{AC} = \begin{pmatrix} 9 \\ 4 \end{pmatrix}$$

Find the magnitude of \overrightarrow{BC}

(3)

Statistics and probability (A03)

No new content

Problem solving skills

Students need to be able to demonstrate problem solving skills by translating problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes.

Questions requiring problem solving skills

KMA0 May 2014 Paper 1F q11

The cost of an adult ticket to a zoo is \$13.50

A teacher buys 4 adult tickets and 24 pupil tickets.

The total cost of the tickets is \$270

Work out the cost, in dollars (\$), of a ticket for one pupil.

KMA0 May 2014 Paper 4H q21

A sphere has a surface area of $81\pi \text{ cm}^2$

Work out the volume of the sphere.

Give your answer correct to 3 significant figures.

Reasoning skills

Students need to be able to demonstrate reasoning skills by:

- Making deductions and drawing conclusions from mathematical information
- Constructing chains of reasoning (e.g. angles questions requiring reasons)
- Presenting arguments and proofs
- Interpreting and communicating information accurately.

Questions requiring reasoning skills

KMA0 May 2014 Paper 1F q4

Here are the first five terms of a number sequence.

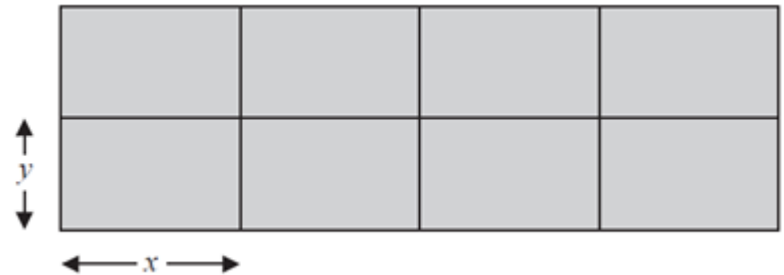
10 14 18 22 26

- (a) Write down the next two terms of the sequence.
- (b) Explain how you worked out your answer.
- (c) Find the 12th term of the sequence.
- (d) Explain why 100 cannot be a term of the sequence.

KMA0 May 2014 Paper 3H q14

A farmer has 180 metres of fencing.

With the 180 metres of fencing,
he makes an enclosure divided
into eight equal, rectangular pens.



The fencing is used for the perimeter of each pen.
The length of each pen is x metres and the width of each pen is y metres.

- (a) (i) Show that $y = 18 - 1.2x$
The total area of the enclosure is $A \text{ m}^2$
- (ii) Show that $A = 144x - 9.6x^2$

Preparing for grade 9

- Usually multi step (but with no structure)
- Mixing of ideas
- Perhaps some problem solving
- Perhaps some mathematical reasoning or proof

Considering Delivery Strategies and sharing best practice

1. Teaching Strategies.
2. Resources.
3. Technology.

Free support materials for International GCSE Maths (9-1)

- Specification
- Sample Assessment Materials
- Training courses from Pearson
- Exam Wizard
- Extra practice questions on the new topics
- Marked Student Exemplars
- Support to develop transferable skills in lessons
- Mapping documents between new GCSE (1MA1) and new International GCSE (4MA1)
- Getting Started Guide and Scheme of Work. Copies of these documents are included in your packs.

Support

Subject Advisor: Graham Cumming



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2. [Examination Results Statistics](#)

Results statistics summarise the overall grade outcomes of candidates sitting Edexcel examinations.

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- See your students' scores for every exam question.
- Understand how your students' performance compares with Edexcel national averages.

Any questions?

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attending this event.**

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ALWAYS LEARNING